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Employee incentives to make firm specific investment: Implications for resource-based theories of corporate diversification

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NOTE

EMPLOYEE INCENTIVES TO MAKE FIRM-SPECIFIC INVESTMENTS: IMPLICATIONS FOR RESOURCE-BASED THEORIES OF CORPORATE DIVERSIFICATION

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We argue that the risk associated with the value of a firm's core resources has an impact on employee decisions to make firm-specific investments, independent of the threat of opportunism that might exist in a particular exchange. We further explore mechanisms firms may adopt to mitigate the employee incentive problem stemming from the risk associated with core resource value. These arguments shed new light on resource-based theories of corporate diversification.

There is a paradox at the heart of current resource-based theories of superior firm performance. On the one hand, these theories recognize that employee firm-specific investments are among the most important sources of economic rents for firms (Barney, 1991). Employee firm-specific investments—including employee knowledge of how a firm operates, knowledge about a firm's key suppliers and customers, and knowledge about how to work effectively with other employees—often meet the criteria established in resource-based logic for generating sustained competitive advantages (Barney, 1991; Dierickx & Cool, 1989). The rents generated by these firm-specific investments are often shared between a firm's employees and its owners (Becker, 1964; Hashimoto, 1981; Rumelt, 1987) and, thus, can be a source of wealth for both the employees and the owners.[1]

On the other hand, a great deal of research in organizational economics suggests that employees who make firm-specific investments risk opportunistic actions by the firms in which they invest (Williamson, 1985). Once employees make firm-specific investments, firms can systematically extract wealth from these employees, and employees have few ways they can protect themselves. Indeed, the hazards associated with making firm-specific investments are so significant that, absent some protection, current theories suggest that employees will avoid making them altogether (Alchian & Demsetz, 1972).

In a great deal of research, scholars have documented ways that employees can protect themselves against the threat of opportunistic behaviors if they make firm-specific investments (Williamson, 1975, 1985). In additional work researchers have identified ways that firms can credibly reassure employees that they will not behave opportunistically in such settings (Castanias & Helfat, 1991; Grossman & Hart, 1986; Jensen & Meckling, 1976; Rajan & Zingales, 1998). With these protections and reassurances in place, current theory seems to suggest that employees will be willing to make firm-specific investments.

However, beyond the threat of opportunism that plagues specific investments made by em-

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[1] How much of the rents will be appropriated by the employees and how much will be appropriated by the firm's owners depend on the relative bargaining power of each party (Coff, 1999).

ployees, there is another risk accepted by employees that has received less attention in the literature.[2] This is the risk that the value of the underlying assets controlled by a firm—the assets that an employee makes investments specific to—will fall. If these assets drop in value, then the value of the investments made by employees that are specific to these assets will also drop. This will be the case even if none of the parties in the exchange engage in opportunistic behaviors. Employees may be very reluctant to make firm-specific investments when the future value of a firm's underlying assets is very risky, even if protections and reassurances are in place that effectively eliminate any threat of opportunism in the exchange.

In this paper we explore the implications for both employees and firms of these risky assets. For employees, we show that risky core firm assets can reduce employee incentives to make firm-specific investments, even when there is no threat of opportunism in these exchanges. For firms, we discuss some actions firms can take to address concerns employees might have about making specific investments in risky firm assets. These actions include directly compensating employees for risk bearing and engaging in resource-based product market diversification. We then explore this latter mechanism in detail and discuss the implications of this analysis for the theory of diversification. We begin by developing a simple model of employee decisions about whether or not to invest in firm-specific human capital that depends both on the threat of opportunism in this exchange and the riskiness of the value of a firm's underlying assets.

[2] Agency theory (e.g., Eisenhardt, 1989; Holmstrom & Milgrom, 1987; Jensen & Meckling, 1976; Shavell, 1979) also stresses the existence of a tradeoff between risk and incentives, but with a specific interest in optimal contract design and appropriate corporate governance mechanisms under varying levels of outcome uncertainty, risk aversion, and information. This paper differs in at least two aspects. First, although the agency literature also concerns itself with the effect of risk considerations on agent incentives, it does not directly address the specific incentive problems associated with employees making specific human capital investments. Second, because of contract incompleteness, the optimal contract design emphasized in the agency literature is rarely the first-best solution (e.g., Shavell, 1979). Thus, it almost always leaves room for firms to adopt strategic risk management mechanisms, such as resource-based diversification strategies.

A MODEL OF EMPLOYEE DECISIONS TO MAKE FIRM-SPECIFIC INVESTMENTS

Two kinds of resources are important in a model of employee decisions to make firm-specific investments: (1) the rare and costly to imitate resources controlled by a firm that an employee is contemplating making specific investments in and (2) the resources controlled by an employee that will be modified if specific investments are made. In this paper we call the first kind of resource a "core firm resource" and the second a "human capital resource."

Of course, not all the resources controlled by a firm are rare and costly to imitate—that is, not all the resources controlled by a firm are core firm resources, as defined here. Indeed, many noncore firm resources—that is, many firm resources that are not rare or costly to imitate—may be necessary if a firm is to gain competitive advantages and earn economic rents. However, these common and imitable resources do not separate firms having the potential to gain competitive advantages from those not having this potential. These firms are separated by the rare and costly to imitate resources they do and do not control.

It is also the case that the possession of rare and costly to imitate resources, by itself, is usually insufficient for a firm to generate economic rents. In addition, employees need to know how to exploit these resources through the strategies a firm pursues. As Porter argues, "Resources are not valuable in and of themselves, but they are valuable because they allow firms to perform activities" (1991: 108).

Noncore firm resources are neither rare nor costly to imitate and, thus, can be exploited by nonspecific human capital investments made by a firm's employees. However, core firm resources will generally require highly firm-specific investments in human capital if they are to be exploited in a firm's strategies. That is, employees must understand the nature of these core resources, develop a working knowledge of how they can be used in conceiving of and implementing strategies, and how they can be protected and nurtured over time if these resources are to be fully exploited in creating competitive advantages and economic rents. These human capital investments have little value in alternative settings but can create a great deal of value in a particular firm.

Now, let us consider an employee, i, of a firm choosing an optimal level of human capital investment specific to a firm's core resource. The amount (units) of specific investments made by this employee is denoted as x_i. Let us assume further that the payoff the employee is expected to appropriate from the total rent generated *per unit* of her specific investment (in combination with the core resource of the firm) is a fraction, $\alpha(0 < \alpha < 1)$, of the total expected amount of rent generated per unit of her specific human capital investment, r_i; r_i is, in turn, an increasing function of the value of the firm's core resource, V. The more valuable the core resource, the more potential rents can be generated from this core resource ($\partial r_i/\partial V > 0$). Thus, the amount of rents appropriated by the employee is αr_i.

Also, assume that the employee incurs an opportunity cost while making specific human capital investments. The opportunity cost comes from the fact that, instead of making specific human capital investments, the employee can alternatively make general human capital investments—for example, developing skills that improve her marketability. Since general human capital does not suffer from the problem of value loss in the case of transfer across business settings, the payoff from the employee's per unit general human capital investment is denoted as $\bar{w}_i$, which is assumed to be a constant.[3]

The total units of human capital investments, including both specific and general, are denoted as n (n can also be thought of as the total hours the employee devotes to making these investments). Since x_i is the total amount of specific investments, the amount of general investments is then $(n - x_i)$. Thus, the employee's total payoff, denoted as w_i, includes the payoffs from both her specific human capital investments ($x_i \alpha r_i$) and her general human capital investments ($(n - x_i)\bar{w}_i$):

$$w_i = \alpha x_i r_i + (n - x_i)\bar{w}_i \quad (1)$$

The employee then chooses the optimal amount of firm-specific investments, x_i, that maximizes her utility. The employee's concern over the risk associated with the payoff from her investments can be captured using a risk-averse utility function. The particular form of standard mean variance utility function is thus chosen to capture the idea that the employee's utilities increase with the expected amount of payoff from her investments, $E(w_i)$, but they decrease with the risk associated with this payoff, $\text{var}(w_i)$ (Sargent, 1987). It follows that the employee solves the following utility function, subject to her payoff constraint[4]:

$$\max_{x_i} U = E(w_i) - \frac{A}{2}\text{var}(w_i)$$

$$\text{where } w_i = \alpha x_i r_i + (n - x_i)\bar{w}_i \quad (2)$$

A is the absolute risk-averse parameter that captures the employee's degree of risk aversion. Without loss of generality, the parameter, A, is normalized to 1 ($A \equiv 1$). The wealth constraint shows that when the employee increases her level of specific human capital investment (higher x_i), her total wealth will covary more with the expected rents generated per unit of specific human capital investment.

From the first-order condition with the normalized risk-aversion parameter ($A \equiv 1$), the optimal amount of specific human capital investment chosen by the employee can be obtained as follows (see the appendix for a more detailed derivation):

$$x_i^* = \frac{\alpha E(r_i) - \bar{w}_i}{\text{var}(\alpha r_i)} \quad (3)$$

[3] In order to focus our attention on the pure effect of resource risk on employee incentives to make *specific* human capital investments, we implicitly assume that *general* human capital investments are risk free. But, in reality, general human capital investments may not be completely riskless. Incorporating the riskiness of general human capital would make investment in firm-specific human capital even more attractive relative to general human capital.

[4] The mean variance risk-averse utility function is originally derived from the exponential utility function, which has the form $U(C) = -e^{-AC}$, where A is the Arrow-Pratt index of absolute risk aversion, given by $A = -U''(C)/U'(C)$. C is the income (payoff) distributed normally with mean μ and standard deviation σ^2. It can then be derived that the agent's expected utility is

$$EU(C) = -e^{-A\left(\mu - \frac{A}{2}\sigma^2\right)}$$

Hence, the objective of the employee is to maximize

$$U = \mu - \frac{A}{2}\sigma^2$$

which is the same utility function used in this paper.

This equation has some important implications. First, the numerator of this equation suggests that the optimal amount of specific human capital investments an employee chooses to make (or an employee's incentive to specialize), x_i^*, depends on the amount of rents the employee is expected to appropriate, $\alpha E(r_i)$, relative to the rents from risk-free general human capital investments. This is perfectly consistent with previous research in organizational economics, which suggests that employee investments in firm-specific human capital can generate economic rents, but the willingness of employees to make these investments depends on how much of the rent they expect to be able to appropriate (Castanias & Helfat, 1991, 2001; Grossman & Hart, 1986; Hart & Moore, 1990; Rajan & Zingales, 1998, 2001). Moreover, a small amount of rent appropriation suggests that an employee expects significant opportunistic actions on the part of a firm, while a large amount suggests that an employee does not expect such actions. Efforts by employees to contractually protect themselves from opportunism, and efforts by firms to reassure employees that they will not behave opportunistically, can both be interpreted as efforts to guarantee that the employees will realize their expected amount of rent appropriation, and thereby increase the likelihood that these employees will make specific human capital investments that generate economic rents.

Second, x_i^* is inversely related to $\text{var}(\alpha r_i)$, the risk associated with the amount of rent an employee expects to appropriate per unit of his or her specific human capital investment. This establishes a basis for the analysis in this paper: the incentives for an employee to make specific human capital investment are negatively affected by the *risk* to the per unit payoff from his or her specific human capital investment. As r_i, the rent generated from an employee's specific human capital investment, increases with V, the value of the core resource owned by the firm, so does the payoff to the employee from his or her per unit specific investment, αr_i. It then follows that the riskiness of this payoff, $\text{var}(\alpha r_i)$, should also increase with the riskiness of the value of a firm's core resources. That is, when the value of a firm's core resource falls, so does the value of employee firm-specific investments and the potential payoff the employee obtains from these investments. Therefore, the riskier the value of a firm's core resources, the lower the employee's incentives to make specific human capital investment.

A lower level of firm-specific human capital investments, in turn, reduces the total amount of rents that can be generated from the underlying core resources and the amount of rents eventually appropriated by the firm. In this setting, the firm has a motive to adopt mechanisms to mitigate employee concerns over the risk to the value of the core resource to induce employees to make these rent-generating investments.

MANAGING THE RISK OF FIRM CORE RESOURCES AND EMPLOYEE INCENTIVES TO MAKE FIRM-SPECIFIC INVESTMENTS

In order for a firm to induce its employees to make firm-specific investments, not only must the firm manage potential opportunism problems in this exchange, but it must also discover ways of managing the risks associated with making human capital investments that are specific to the firm's risky core resources. We consider two possible solutions to this problem here: (1) compensating employees directly for accepting these risks and (2) using resource-based related diversification to mitigate these risks.

Compensation to Employees for Risk Bearing

The most straightforward solution to the employee incentive problem stemming from the riskiness of a firm's core resources seems to be for the firm to directly compensate employees for bearing this risk—that is, pay "key employees" to make firm-specific investments. Theories and empirical findings in the strategic management literature indeed suggest that diverse stakeholders, including a firm's employees, suppliers, and customers, often demand compensation for risk bearing (Aaker & Jacobson, 1990; Amit & Wernerfelt, 1990; Deephouse & Wiseman, 2000; Miller, 1998; Miller & Chen, 2003). The expected amount of payment to the employees should be based on an estimation of the risk to the value of firm core resources to which these employees are making specific human capital investments.

These observations lead to the following proposition:

Proposition 1: The higher the risk associated with a firm's core resources, the more likely it is the firm's key employees will have a larger amount of total expected compensation.

However, compensating employees for risk bearing has some limitations in functioning as an effective employee incentive mechanism. First, it can be very difficult to write and enforce a compensation contract (Hart, 1995; Titman, 1984). Bounded rationality linked with environmental uncertainty makes it difficult, if not impossible, to identify all the future states of nature that might affect the value of a firm's core resources. Even if these states could be anticipated, their specific effects on the value of core resources and employee-specific investments would remain challenging to quantify. Because firm core resources are rare and nontradable and employee-specific human capital investments are intangible, both are difficult to value. Moreover, the firm may default on the terms of the compensation contract in the case of severe negative economic outcome. For example, a firm may approach bankruptcy when it no longer has valuable assets that allow it to continue to operate. In such a case, the terms of the contract cannot be effectively enforced.

Second, although compensating employees for risk bearing can, to some extent, create incentives for them to make firm-specific human capital investments, it directly increases firm expenditures and, thus, imposes costs on the firm (Miller & Chen, 2003). When the risk associated with firm core resources is very high, it becomes increasingly expensive for the firm to compensate employees for risk bearing, despite the motivational benefits of such compensation. As the risk associated with a firm's core resource increases, for a given amount of effort to make firm-specific investments, the employee will demand higher compensation, resulting in higher marginal cost per unit effort and no corresponding increase in the expected revenue for the firm. Therefore, it may not pay for the firm to motivate employees beyond a certain point through compensation, because the utility of an additional unit of effort to make firm-specific investment is worth less to the firm than the cost of motivating employees for an incremental unit of effort. Thus, the optimal compensation schedule often does not fully compensate employees for risk bearing (Shavell, 1979). This, of course, will leave employees to reduce efforts and to underinvest in firm-specific human capital.

Because of the limitations associated with compensating employees for risk bearing and because of the costs of such compensation imposed on the firm, sometimes the firm may be better off finding additional ways to reduce the risk associated with core resources. Resource-based product market diversification is one such alternative.[5]

Resource-Based Corporate Diversification

Generally, the value of a firm's core resource is determined in the product markets where that resource is deployed (Barney, 1991; Bowman & Amrosini, 2000; Peteraf, 1993). This implies that if the firm's core resource can be deployed in multiple product markets, the value of the resource in one product market is likely to be different from that in the other product markets. Moreover, a change in the value of a core resource in one product market may not necessarily affect its value in a different product market. This suggests that the risk associated with core resources can be reduced by exploring the applicability of these core resources in other product markets and diversifying accordingly.

Note that diversifying into multiple product markets by deploying a firm's core resource does not directly reduce the risk to the resource value in each *individual* product market. However, as long as the factors that lead to changes in one product market are not perfectly correlated with those in another product market, uncertainty in one product market that has a significant effect on the value of the core resource in that particular market is not likely to have a similar effect in another market. Therefore, through diversifying into product markets with less than perfectly correlated environmental

[5] A strategy of resource-based related diversification directly deals with the risk to core resource value. This makes such a risk reduction mechanism more appealing in the context of this paper than some other potential firm-level risk management mechanisms, such as financial hedging and unrelated diversification. However, these alternative mechanisms may be effective in reducing overall firm-level risk exposure, but the risk to the value of the fundamental core resources is not likely to be affected significantly. See Miller (1992, 1998) for a detailed discussion of these alternative firm-level risk management tools.

factors, a firm can reduce the overall risk associated with the value of the core resource. This risk reduction, in turn, can potentially increase employees' incentives to make human capital investments that are specific to the firm's core resources.[6] Generally speaking, the positive effect of resource-based product market diversification on employee incentives is expected to increase with the level of the risk associated with the firm's core resources in the firm's original market(s).

These observations lead to the following proposition.

> *Proposition 2: The higher the risk associated with a firm's core resources, the more likely it is the firm will diversify into other product markets based on those core resources.*

To the extent that resource-based product market diversification can substitute for compensating employees for risk bearing as the means of facilitating employees to make firm-specific human capital investments, the ability for a firm to engage in resource-based diversification can reduce the need for the firm to pay employees for risk bearing.

> *Proposition 3: Ceteris paribus, firms that have diversified based on their core resources will subsequently compensate their key employees at a lower level than if they have not diversified in this way.*

Note that the arguments above are built on the implicit assumption that management is able to implement a resource-based diversification strategy in such a way that the risks of existing firm businesses are not altered. However, to the extent that the existing businesses are disturbed, the effect of resource-based diversification on risk reduction and therefore on employee incentives should be discounted accordingly.

IMPLICATIONS FOR THEORIES OF DIVERSIFICATION

Note that the pattern of diversification and the definition of resource relatedness discussed above are, in spirit, very close to those based on the concept of the "strategic asset" in the resource-based theory of diversification (e.g., Markides & Williamson, 1994, 1996; Teece, 1982). To the extent that a *core firm resource* is rare and costly to trade, the diversification pattern predicted in this paper—that is, diversification by deploying core firm resources—resembles the resource-based theory of corporate diversification, which argues that multibusiness organizations exist to exploit economies of scope by sharing rare and costly to imitate strategic assets among businesses (Mahoney & Pandian, 1992; Peteraf, 1993; Teece, 1982).[7] However, there are some important differences in the pattern of corporate diversification derived from this theory of diversification and traditional resource-based theories of diversification. These differences are manifested in the path and the scope of diversification.

Diversification Path

Traditional resource-based logic suggests that diversification is appropriate when a firm's resources are applicable across the multiple businesses the firm engages in (Markides & Williamson, 1994; Montgomery & Wernerfelt, 1988; Silverman, 1999). The logic developed here indicates that risk reduction, in addition to the ability to apply firm resources across multiple businesses, may motivate diversification. This suggests that a diversifying firm will look to exploit its current resources and capabilities in its diversification moves but that it will also

[6] Note that in addition to the need for employees to make human capital investments that are specific to a firm's core resource, a diversified firm may also need to induce its employees to make investments that are specific to a specific product market the firm operates in. This usually requires different firm policies, such as appropriate compensation mechanisms, which we do not specifically address. However, this consideration should not directly affect the arguments made here, as long as the firm requires employees to make substantial specific investments at the core resource level.

[7] Note that the core resource in this paper is not exactly the same as a "strategic asset." While the strategic asset can be a source of firm rents, the core resource itself does not generate rents. It can only be a source of rents when it is combined with specific human capital investments by employees. Moreover, Markides and Williamson (1994, 1996) argue that in addition to realizing economies of scope, diversification may help improve a firm's current strategic assets and build new ones.

look for businesses where it can apply those resources that have cash flows that are uncorrelated with its current business activities.

> *Proposition 4: Firms that diversify into businesses that exploit their current core resources and that have a pattern of cash flow that is not highly correlated with their current businesses will generate higher levels of employee firm-specific investment than firms that diversify into businesses that only exploit their current core resources but have a pattern of cash flow that is highly correlated with their current businesses.*

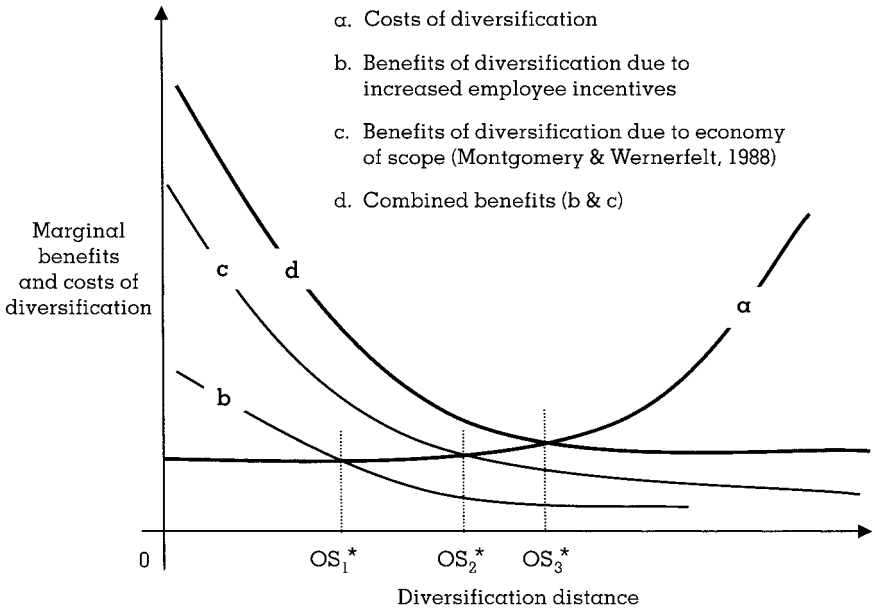
Diversification Scope

Traditional resource-based logic suggests that there are often decreasing returns associated with diversification. This is because, generally, firms will diversify into a related business with the highest potential return first, that with the second highest potential return second, and so forth. Barring an exogenous shock that changes the value of a firm's core assets, the last diversification moves made by a firm that exploit a particular core resource are likely to be less valuable than the first few diversification moves exploiting that resource.

The theory of diversification developed here also suggests that returns from risk reduction (i.e., the willingness of employees to make firm-specific investments that have rent-generating potential) will also have decreasing returns. This is because portfolio risk is generally a concave function of the number of assets in the portfolio (Elton & Gruber, 1995), which implies that, with the increase in the number of businesses a firm diversifies into, the overall risk to the value of the core resources falls, but at a decreasing rate. A decreasing incremental amount of risk reduction is then likely to lead to decreasing returns for the firm.

However, while both resource exploitation and risk reduction may be characterized by decreasing returns, these two benefits of diversification may not move together over time. Figure 1 shows that as a firm diversifies further away from its original businesses, both the marginal

FIGURE 1
The Determinants of the Optimal Scope of a Firm



Note: OS_1^* is the optimal scope when only the benefit from employees' increased investment incentives is considered; OS_2^* is the optimal scope when only the benefit from economies of scope is considered; OS_3^* is the optimal scope when both the benefits of economies of scope and employee incentives are considered.

advantage obtained from exploiting economies of scope and that obtained from providing incentives for employees to specialize are expected to decrease, and the marginal cost of diversification is expected to increase. When considering each effect separately, the optimal scope of the firm is determined by the point where the marginal revenue of diversification equals marginal cost (OS_1^* and OS_2^* in Figure 1). However, when both effects are considered, the optimal diversification distance is at OS_3^*, where the marginal revenue of diversification from the combined effects equals the marginal cost of diversification.

Of course, the analysis in Figure 1 assumes that the benefit from realizing economies of scope, which is determined by the applicability of a core firm resource (or strategic asset) in other product markets, and the benefit from providing employee investment incentives, which is determined by the degree of reduction in risk to the core resource value, are not correlated. To the extent these benefits are correlated, the optimal diversification scope would be less than OS_3^* (Figure 1). Some strategy scholars have suggested that businesses that exploit the same underlying core resources can nevertheless have very different patterns of cash flow over time (e.g., Markides & Williamson, 1994, 1996; Prahalad & Hamel, 1990), implying a low correlation between these two benefits from diversification. However, the extent to which these benefits are correlated is ultimately an empirical question. All this suggests the following.

> *Proposition 5: When the benefits of realizing economies of scope and increased employee incentives to specialize are not perfectly correlated, a firm will diversify more widely than when only one of the benefits is considered, and the optimal diversification scope increases with a decrease in the correlation between the two benefits.*

Finally, it is worth noting that this paper's emphasis on risk reduction from diversification is also related to the argument of agency theory, in which diversification is used to reduce overall firm risk exposure. The agency argument, however, considers diversification as an outcome of conflicts between shareholders and managers, since it reduces managers' employment risk, but at the expense of the shareholders of the firm (Amihud & Lev, 1981). In contrast, we argue here that shareholders as well as employees (including managers) potentially gain from the firm's diversification, because diversification encourages employees to join the firm and to invest in firm-specific knowledge and skills. Another notable difference between these two perspectives is that central to our argument is "resource-based" diversification (related), which reduces risks associated with the core resources. In contrast, agency theory emphasizes conglomerate diversification (unrelated), which leads to financial risk reduction—that is, it smooths cash flow at the corporate level but does not effectively reduce the risk of the underlying core resources.

CONCLUSION

We have argued that the risk associated with the value of a firm's core resources has an impact on employee decisions to make firm-specific investments that are often crucial for rent creation. We have further demonstrated that resource-based product market diversification reduces the risk associated with the value of core firm resources and, therefore, provides positive incentives for employees to make these specific investments. Incorporating this perspective into research on diversification motives holds the potential for a more comprehensive understanding of this important phenomenon in modern corporations (e.g., Montgomery, 1994).

The paper also provides important implications for a firm's senior managers. It suggests that managers implementing a resource-based diversification strategy should take into consideration the effect of diversification on employee incentives. Such a consideration not only can lead to a different diversification path but may also lead to a different optimal diversification scope.

The arguments that are advanced here, however, are only a first step toward a more thorough understanding of the roles of risk and employee incentives in resource-based theories. In future research scholars need to address some limitations of the current paper and further our understanding in these areas.

The first area that requires further research attention is associated with formal modeling. Here we have assumed a linear rent-sharing scheme between the employee and the firm.

Since firm rents are assumed to be normally distributed, so is the amount of payoff to the employee's specific investments, suggesting a symmetrical upside and downside risk associated with the employee's payoff. However, sometimes a nonlinear payoff function, such as an optionlike function with a component of payment that is fixed, seems to be a more plausible assumption. These issues concerning the interaction between the payment and rent-sharing function and the shape of the distribution of uncertain outcomes may be an interesting future research direction.[8]

Second, we have focused on the discussion of the role of core resources and resource-based diversification as an important mechanism for reducing the risks associated with these core resources. Nevertheless, we have omitted some other relevant strategic questions that deserve future research attention. For example, when implementing a resource-based diversification strategy, what noncore resources should the firm internalize with the core resources? How should firm strategies be different in utilizing these different types of resources? How do complementary noncore resources affect the risk associated with core resources? While it is beyond the scope of this paper to include the discussion of these issues, future research along this path will help complete a theory of core resources and employee incentives.

The third area that requires further research efforts is related to the limitation of the applicability of the current framework. The ideas here are most applicable to firms that face moderate levels of uncertainty, but not to those that operate in either very stable or extremely volatile environments. In a stable environment the value of a firm's core resource is also likely to be stable, and rents generated from the resource and employee-specific human capital can be sustained over a long period of time. In this setting employees have stronger incentives to specialize and to appropriate their share of the rents. In an extremely volatile environment, however, rents may become so short-lived that inducing employees to make specific investments can be too costly. Furthermore, when changes in environmental factors render the core firm resource itself obsolete, diversification by deploying the core resource will no longer be effective in preserving the value of the resource. In this case, a better strategy for the firm is to develop capabilities that enable the firm to efficiently adapt to constantly changing and fast-evolving environments. Although the recent dynamic capabilities literature (Teece, Pisano, & Shuen, 1997) helps address this issue, it is clearly an area that deserves further research attention.

[8] We would like to thank two anonymous reviewers for this point. Note that the consideration of nonlinear payoff function is not crucial for our purpose here, since the main arguments hold as long as there is an inverse relationship between core resource risk and employee incentives to specialize and this inverse relationship exists for both types of payoff distributions.

APPENDIX
DERIVATION OF EQUATION (3)

Plugging the employee payoff constraint

$$w_i = \alpha x_i r_i(V) + (n - x_i)\bar{w}_i$$

into the utility function

$$U = E(w_i) - \frac{A}{2}\text{var}(w_i)$$

we then have

$$U = E(w_i) - \frac{A}{2}\text{var}(w_i) = \alpha x_i E(r_i) + (n - x_i)\bar{w}_i - \frac{A}{2}[x_i^2\text{var}(\alpha r_i)]$$

which is to be maximized with respect to x_i. With normalized risk-aversion parameter ($A \equiv 1$), the first-order condition (with normalized A) for x_i is

$$U'_{x_i} = \alpha E(r_i) - \bar{w}_i - x_i\text{var}(\alpha r_i) = 0$$

The x_i^*, the amount of specific human capital investments that maximize the employee's utility, can be obtained by solving the above equation for x_i:

$$x_i^* = \frac{\alpha E(r_i) - \bar{w}_i}{\text{var}(\alpha r_i)}$$

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